

COMPOSITIONS AND METHODS FOR DRUG DELIVERY

BACKGROUND

Field of the Disclosure

[0001] The disclosure relates generally to compositions comprising coated particles and to methods of making and using such compositions for targeted drug delivery.

Brief Description of Related Technology

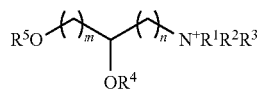
[0002] Nanoparticles (including nanospheres) and microparticles (including microspheres) referred to herein collectively as “particles,” are solid or semi-solid particles having a diameter from about 1 nm to about 10,000 nm (10 microns), preferably from about 1 nm to about 2,000 nm (2 microns). Such particles can be formed from a variety of materials, including proteins, synthetic polymers, polysaccharides, nucleic acids, small molecules, and combinations thereof, and have been used in many different applications, primarily separations, diagnostics, and drug delivery.

[0003] Compositions comprising such particles have been found to be useful for drug delivery. For example, U.S. Patent Publication No. 2006/0073199 discloses that particles comprising an active agent can be formulated as aqueous suspensions, and stabilized against aggregation and particle growth by providing surfactant coatings on or about the particles.

[0004] There is an on-going need for development of compositions comprising particles and methods for making and using same, particularly in delivering drugs of interest.

SUMMARY

[0005] One aspect of the invention is directed to a surface-modified particle comprising a particle core and a coating associated with the particle core. The particle core comprises an active agent, such as a therapeutic agent or a diagnostic agent (e.g., a small organic molecule or a biomacromolecule). The coating comprises a surfactant having formula I:



wherein n and m are independently selected from the group consisting of 1, 2, 3, 4, 5, and 6; R¹, R², and R³ are independently selected from C₁ to C₈ alkyl; and R⁴ and R⁵ are independently selected from the group consisting of C₆ to C₄₀ alkyl, C₆ to C₄₀ alkenyl, C₆ to C₄₀ alkynyl, C(=O)(C₅ to C₃₉ alkyl), C(=O)(C₅ to C₃₉ alkenyl), and C(=O)(C₅ to C₃₉ alkynyl). The surface-modified particles according to the present invention generally have an average size from about 1 nm to about 2,000 nm.

[0006] Another aspect of the invention is directed to a method of enhancing cellular uptake of an active agent. The method comprises contacting cells with surface-modified particles under conditions sufficient to enhance cellular uptake of the surface-modified particles. The particles comprise a particle core and a coating associated with the particle core, wherein the particle core comprises an active agent, the coating comprises a surfactant of formula I, as

defined herein, and the surface-modified particle has an average size from about 1 nm to about 2,000 nm.

[0007] Another aspect of the invention is directed to a method for treating a subject having an inflammatory disease or disorder comprising administering to said subject a plurality of surface-modified particles, said surface-modified particles comprising a particle core and a coating associated with the particle core, wherein the particle core comprises an active agent (e.g., an anti-inflammatory agent), the coating comprises a surfactant of formula I, as defined herein, the surface-modified particle has an average size from about 1 nm to about 2,000 nm, and said administration is effective in alleviating, treating, and/or preventing symptoms or pathologies associated with said inflammatory disease or disorder.

[0008] Another aspect of the invention is directed to a method for treating a subject having a proliferative disease or disorder comprising administering to said subject a plurality of surface-modified particles, said surface-modified particles comprising a particle core and a coating associated with the particle core, wherein the particle core comprises an active agent (e.g., an anti-proliferative such as an antineoplastic agent), the coating comprises a surfactant of formula I, as defined herein, the surface-modified particle has an average size from about 1 nm to about 2,000 nm, and said administration is effective in alleviating, treating, and/or preventing symptoms or pathologies associated with said proliferative disease or disorder.

[0009] Another aspect of the invention is directed to a method for treating a subject having an infectious disease or disorder comprising administering to said subject a plurality of surface-modified particles, said surface-modified particles comprising a particle core and a coating associated with the particle core, wherein the particle core comprises an active agent (e.g., an anti-infective agent), the coating comprises a surfactant of formula I, as defined herein, the surface-modified particle has an average size from about 1 nm to about 2,000 nm, and said administration is effective in alleviating, treating, and/or preventing symptoms or pathologies associated with said infectious disease or disorder.

[0010] In another aspect, the invention is directed to a method for treating a subject having a neurodegenerative disease or disorder comprising administering to said subject a plurality of surface-modified particles, said surface-modified particles comprising a particle core and a coating associated with the particle core, wherein the particle core comprises an active agent (e.g., an anti-neurodegenerative agent), the coating comprises a surfactant of formula I, as defined herein, the surface-modified particle has an average size from about 1 nm to about 2,000 nm, and said administration is effective in alleviating, treating, and/or preventing symptoms or pathologies associated with said neurodegenerative disease or disorder.

[0011] Another aspect of the invention is directed to a method for treating a subject having an infectious disease or disorder, an inflammatory disease or disorder, a neurodegenerative disease or disorder, or a proliferative disease or disorder comprising administering to said subject a plurality of surface-modified particles into a body cavity having a site of disease or inflammation, said surface-modified particles comprising a particle core and a coating associated with the particle core, wherein the particle core comprises an active agent, the coating comprises a surfactant of formula I, as